Title: Creating UTH-Related FCDRs from IR and Microwave Sensors Cross-Calibrated by In Situ Measurements from Commercial Aircraft

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Upper-tropospheric humidity (UTH) remains one of the least well-measured and most poorly understood components of the water vapor cycle. Although occurring in very small amounts, its radiative effects are significant in determining the energy budget of the earth's climate system and the overall climate sensitivity. The goal of this proposal is to bring together all the UTH-relevant radiance data from multiple satellites and process them to establish a long-term, global radiance record from which a climate record of UTH variations can be retrieved and UTH research may be conducted.

A unique aspect of this proposal is its calibration component. Instead of just cross checking one satellite with another, we propose to bring in an independent and highly accurate calibration anchor – the MOZAIC (Measurement of Ozone and Water Vapour by Airbus In-Service Aircraft) project. Another key feature of the proposal is the emphasis on microwave data. Although IR UTH radiances (near wavelengths of 6.3 - 6.7 μm) have been intensively studied in the past for FCDR purpose, their microwave counterpart (~ 183 GHz) has received much less attention. By collocating the IR and microwave observations, we can also exploit the insensitivity of the microwave to cloud contamination. Finally, we will produce a single, homogeneous record of UTH-related radiances (starting from 1992 because microwave UTH data are only available from then), while preserving the separate parallel versions of each type of UTH-related radiances (some of which date back to late 1970s) for different applications. The matched MOZAIC/satellite dataset, which is a subset of the original data and provides the anchor for inter-calibration of all the radiances, will also be delivered along with the calibrated radiance dataset.

The proposed study here addresses questions that are directly related to the SDS's program objectives and priorities. "Mature algorithms" will be applied to "multiple satellites and sensors which together span climate-relevant time periods". Also, the UTH FCDR as proposed here is specifically identified as an "initial priority parameter" solicited by this announcement, namely, "thermal infrared and microwave sounder SDR (Sensor Data Record)". Finally, as part of the NOAA Cooperative Institute, NOAACREST Center, our proposed activities fit in with the Center's "Hydroclimate" theme and will expand the activities, which currently focus on the lower troposphere, to include the cold upper troposphere.